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(54) PWM OUTPUT METHOD

(57)Abstract:

PURPOSE: To enable high-accuracy resolution by averaging the output of PWM (pulse width modulation) (n) times so as to improve the resolution of the PWM output (n) times as much as the resolution of a timer.

CONSTITUTION: When the PWM output is executed while providing the (n) number of the average values of values to be set to a comparison register by using the timer having the resolution of 8 bits (28), the (n) averages are outputted. In this case, the PWM output can be obtained with the resolution of 2(8+n). By averaging the (n) PWM outputs, the resolution is improved to be (n) times as much as the resolution of the timer. Thus, the PWM output is enabled while improving the resolution to be (n) times as much as the resolution of the timer.

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Japanese Kokai Patent Publication H4-96417, published March 27, 1992; Application No. H2-211990, filed August 10, 1990; Inventor: Akiko OGAWA; Assignee: Nippon Denki Ai Shi Maikon Shisutemu KK (NEC IC Microcomputer Systems, Ltd.)

PWM OUTPUT METHOD

Claim

PWM output method characterized in that the average of *n* PWM output times is carried out, and the resolution of the PWM output is raised by *n* times the resolution of a timer.

Detailed Description of the Invention

[Field of Use in Industry]

The present invention concerns a PWM (pulse width modulation) method; in particular, it concerns a PWM output method whereby the resolution is raised by averaging the PWM output *n* times.

[Prior Art Technology]

PWM output resolution depends on timer resolution (number of count bits, hereinafter the same) generating timer interruption requests which determine the duty ratio of the active level of PWM output.

In Figure 5, a block diagram of the basic hardware of a conventional PWM output is shown. In Figure 5, when the value of a timer register (1) agrees with the value of a comparison register (2), a timer interruption request (3) is generated, and PWM output (4) is carried out.

Figure 6 is a timing diagram of the PWM output which depends on the timer resolution where the resolution generates timer interruptions. In Figure 6, when the timer register value (5) agrees with the comparison register value (6), a timer interruption request (7) is generated, and the duty ratio of the active level of the PWM output (8) is determined. This operation is repeatedly carried out.

[Problems the Invention is Meant to Resolve]

The resolution of the aforementioned PWM output is dependent on the resolution of the timer whose duty ratio generates determined timer interruptions. Therefore, when the PM output is used for controlling the rotary speed of a direct-current motor, for example, even when the number of divisions of the rotary speed is at a maximum, this becomes the resolution of the timer.

The objective of the present invention is to offer a PWM output method whereby the aforementioned defects are resolved, and whereby resolving is possible with high precision and without direct dependence on the resolution of the timer.

[Means for Resolving Problems]

The composition of the PWM output method of the present invention is characterized in that the average of *n* PWM output times is carried out, and the resolution of the PWM output is raised by *n* times the resolution of a timer.

[Embodiment]

The present invention is explained below with reference to the drawings.

Figure 1 is a flow chart showing an algorithm for making table data in an embodiment of the present invention. Figure 2 is a diagram showing a data table prepared with values set in the comparison register (2) in Figure 5 when a timer with an 8-bit (2^8) resolution is used and PWM output having a resolution of 10 bits (2^{10}) is carried out.

In Figure 2, the respective table values (9, 10, 11, 12) are the average values of the values set in the comparison register (2) whereby the duty ratio carries out a PWM output of $m/2^{10}$ (m is an integer). The table data number in this case must be $2^{10}/2^8 = 4$.

Figure 1 is a flow chart showing an algorithm for composing a data table. In process 2, the quotient when m (duty ratio = $m/2^{10}$) is divided by 4 is the average value of the values set in the comparison register. This average value is housed in a 4-byte table (process 3). Subsequently, the remainder in the result of process 2 is distributed to the respective table data in process 4. Process 1 is the start of the table data composition, and process 5 is the end of said composition. At this time, when the remainder is 2 or greater, it is desirable for the quotient and quotient + 1 data to be alternately aligned (in Figure 3, data tables [9', 10', 11', 12'] are shown when the remainder is 2).

Figure 4 is a timing diagram for the embodiment described above of the present invention. In Figure 4, the respective comparison registers (17, 18, 19, 20) correspond to the data table values (9, 10, 11, 12) in Figure 2. When the time register value (13) agrees with the comparison register value (17), a timer interruption request is generated, and the duty ratio of the active level of the PWM output (26) is determined. At the same time, during the timer interruption process, the table value (11) within Figure 1 is compared, and is set as the register value (19). When the timer and register values (15, 16) agree with the comparison register values (19, 20), the same operation is carried out. This series of operations is repeatedly carried out.

With the method of Figure 1, the average value of the values set into the comparison register has *n* parts, and when PWM output is carried out as shown in Figure 4, *n* averages are output. In this case, a PWM output with a resolution of $2^{(8+n)}$ is obtained.

With the PWM output method of the present embodiment, by averaging the PWM output *n* times (*n*: expected resolution α / timer resolution β; α and β are powers of 2, hereinafter the same), the resolution is raised to timer resolution × *n*.

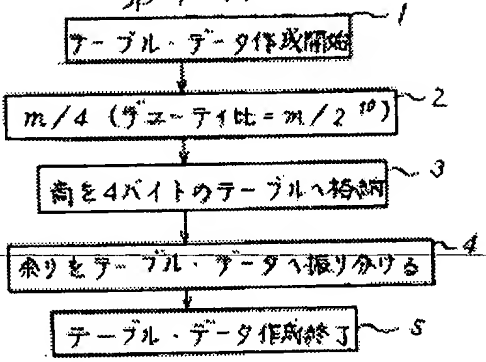
[Results of the Invention]

As has been explained above, with the present invention, because of the fact that *n* PWM outputs are averaged, PWM output whose resolution is raised to timer resolution × *n* can be carried out.

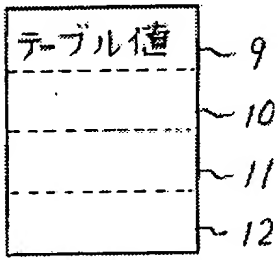
Simple Explanation of the Drawings

Figure 1 is a flow chart showing an algorithm for making table data in an embodiment of the present invention, Figure 2 is a diagram showing a data table prepared with values set in the comparison register in an embodiment of the present invention, Figure 3 is a diagram showing a data table where quotient and quotient + 1 data are alternately aligned in the case of a remainder of 2 from the result of *m*/4, Figure 4 is a timing diagram in an embodiment of the present invention, Figure 5 is a basic hardware block diagram of conventional PWM output, and Figure 6 is a timing diagram of PWM output which depends on the timer resolution where the resolution generates timer interruptions.

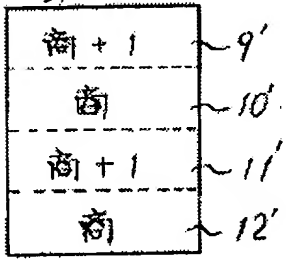
第1図


テーブル・データ作成開始
1
m/4（デューティ比＝m/2^10）
2
商を4バイトのテーブルへ格納
3
余りをテーブル・データへ振り分ける
4
テーブル・データ作成終了
5

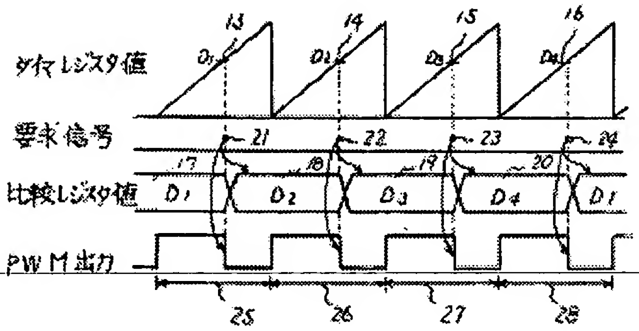
第2図


テーブル値

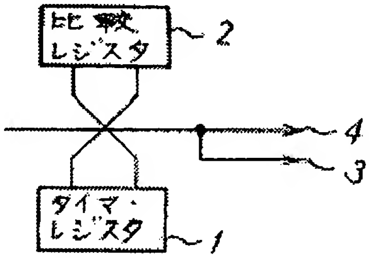
第3図


商＋1
9′
商
10′
商＋1
11′
商
12′

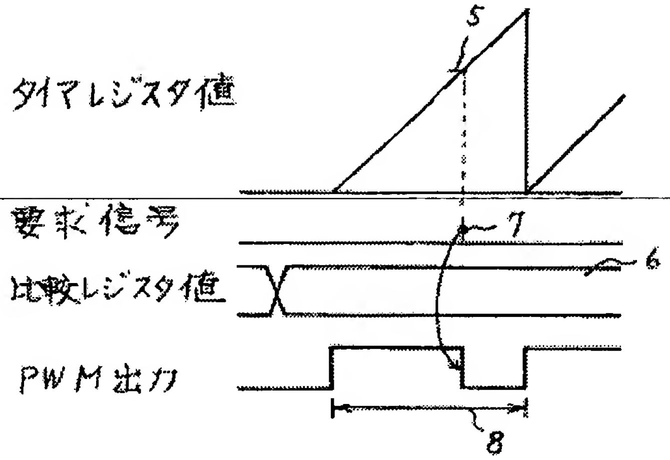
第 4 図


タイマレジスタ値
要求信号
比較レジスタ値
PWM出力
D1
D2
D3
D4
D1

第 5 図


比較レジスタ
タイマ・レジスタ

第6図


5
タイマレジスタ値
要求信号
7
6
比較レジスタ値
PWM出力
8

Translations Branch
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TITLE: PWM OUTPUT METHOD

Abstract Text - FPAR (1):

PURPOSE: To enable high-accuracy resolution by averaging the output of PWM (pulse width modulation) (n) times so as to improve the resolution of the PWM output (n) times as much as the resolution of a timer.

Abstract Text - FPAR (2):

CONSTITUTION: When the PWM output is executed while providing the (n) number of the average values of values to be set to a comparison register by using the timer having the resolution of 8 bits (28), the (n) averages are outputted. In this case, the PWM output can be obtained with the resolution of 2(8+n). By averaging the (n) PWM outputs, the resolution is improved to be (n) times as much as the resolution of the timer. Thus, the PWM output is enabled while improving the resolution to be (n) times as much as the resolution of the timer.

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